

(43) Date of A Publication 25.04.2001

(21) Application No 9924887.4

(22) Date of Filing 20.10.1999

(71) Applicant(s)  
Motorola Limited  
(Incorporated in the United Kingdom)  
Jays Close, Viabes Industrial Estate, BASINGSTOKE,  
Hampshire, RG22 4PD, United Kingdom

(72) Inventor(s)  
Timothy John Robinson

(74) Agent and/or Address for Service  
Motorola Limited  
European Intellectual Property Department,  
Midpoint, Alencon Link, BASINGSTOKE, Hampshire,  
RG21 7PL, United Kingdom

(51) INT CL<sup>7</sup>  
H04Q 7/32, H04M 1/274, H04Q 7/38

(52) UK CL (Edition S)  
H4L LRCMR L1H10 L209

(56) Documents Cited  
GB 2328117 A GB 2300089 A GB 2282732 A  
WO 98/20663 A2 WO 98/20662 A2 WO 97/11546 A1

(58) Field of Search  
UK CL (Edition R) H4K KBC KBNX KED KER KEX, H4L  
LDSY LECCX LESF  
INT CL<sup>7</sup> H04M 1/274, H04Q 7/32 7/38  
ONLINE: WPI, JAPIO, EPODOC

(54) Abstract Title  
Call routing table for a mobile telecommunications system

(57) The invention concerns the provision of call routing, preferably least cost routing, which does not require a user of a mobile to select the route and input the required codes or prefixes associated with a particular route. A routing table for calls from a mobile terminal of a telecommunications system is preferably stored in the mobile terminal. The table is provided with at least a first set of data representative of numbers to be input by a user and a second set of data representative of numbers to be dialed by the terminal, the numbers of the second set each being mapped to a respective one of the first set of data. Further data sets associated with other parameters or conditions (e.g. network location) may also be stored and used to determine the dialled number. Data representative of choice or priority levels may also be stored and the routing data may be updated by the system. The number dialled may be obtained by replacing part of the input number with numbers determined from the table. Useful when routing calls via different networks (home, roam) or for call "break out", i.e. when enter into the public network via a company PABX to take advantage of cheaper rates.

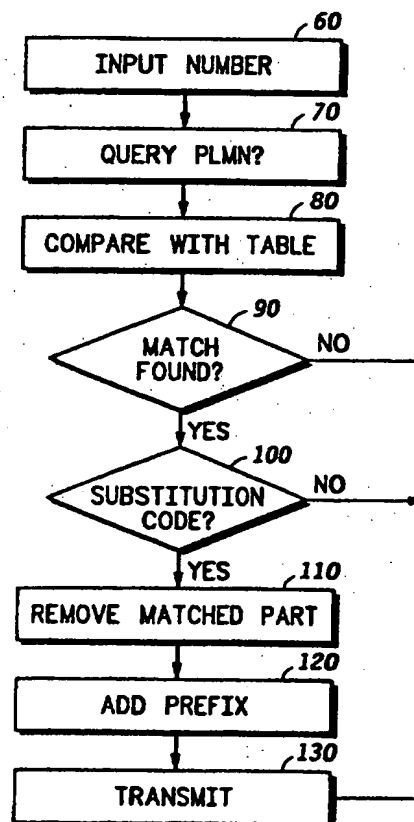
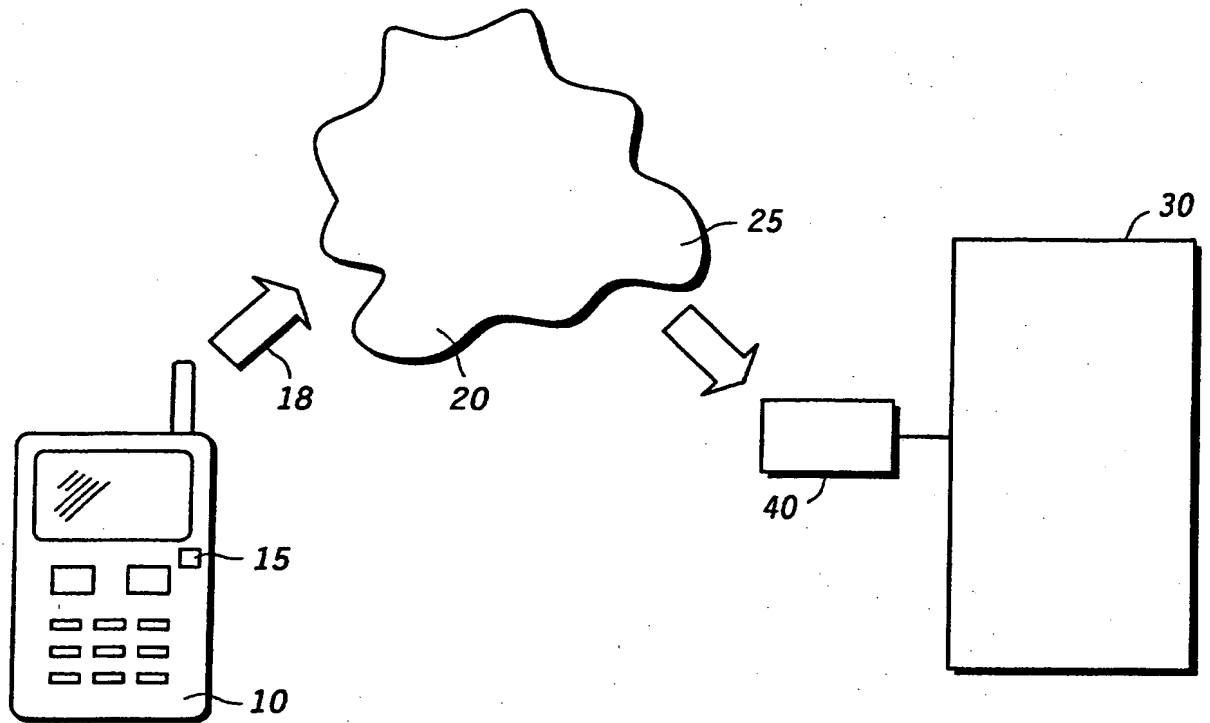
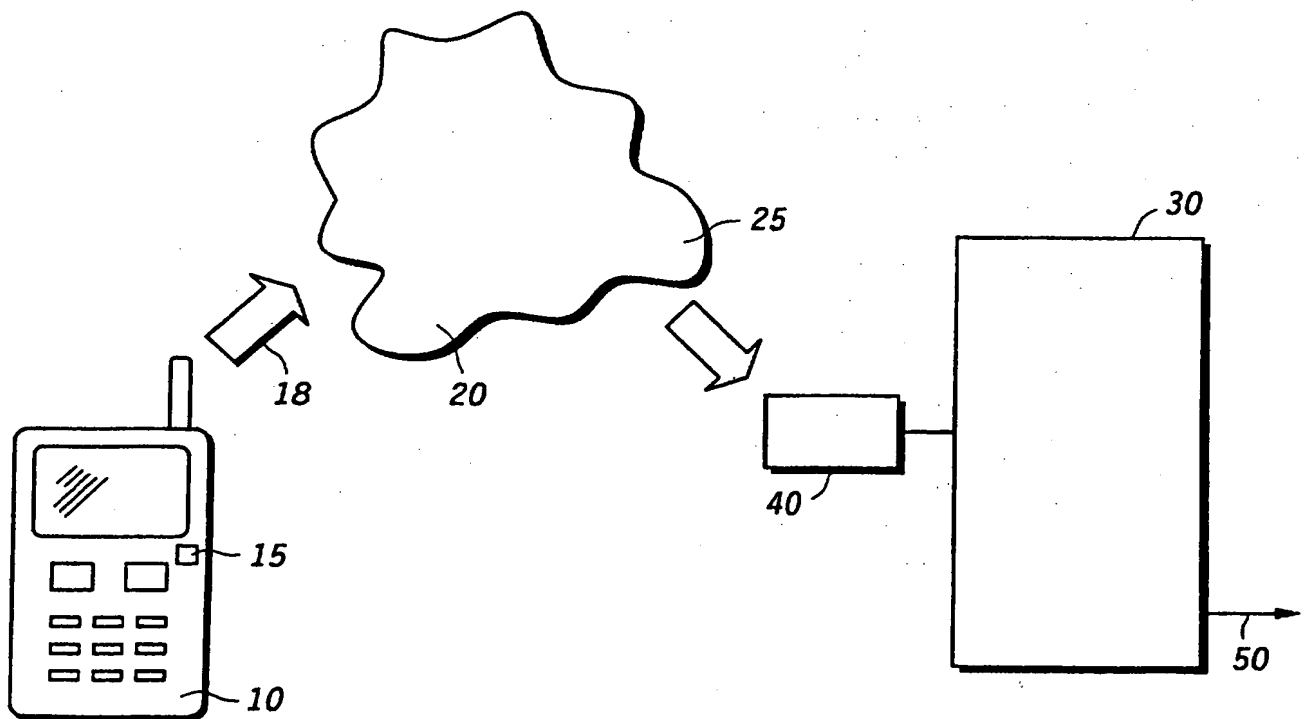


FIG. 3

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

*FIG. 1**FIG. 2*

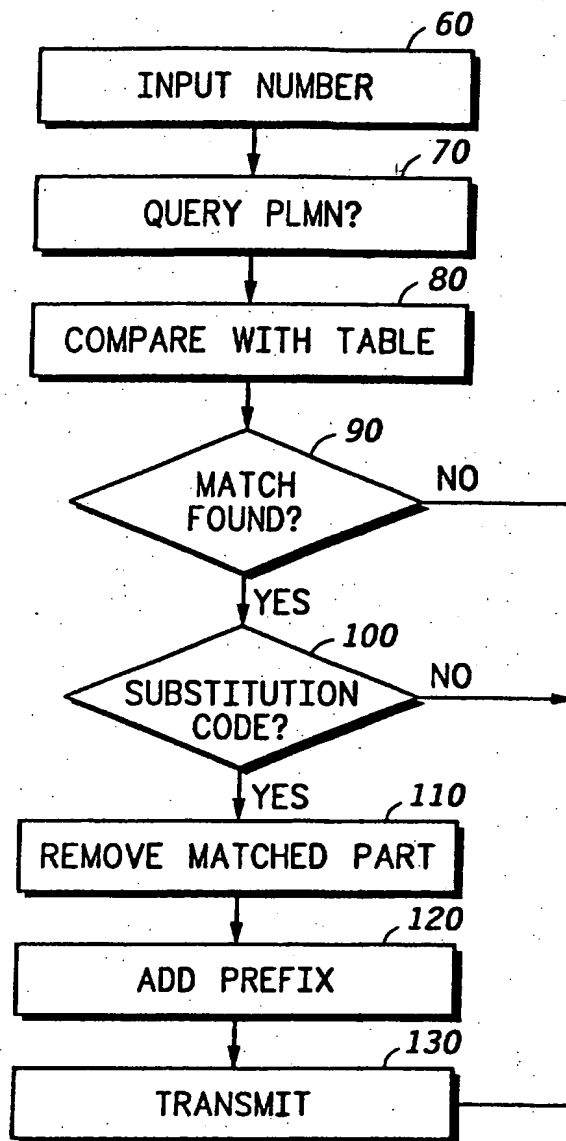


FIG. 3

ROUTING OF CALLS MADE BY MOBILE TELECOMMUNICATIONS  
SYSTEMS

Background of the Invention

This invention relates to routing of calls made by mobile telephone communications systems. In particular, it relates to mobile telephone cellular networks and to the routing of calls made from these.

Mobile telephone networks now cover a large proportion of the globe, thus allowing communication between mobile users, or allowing calls commencing or terminating at a mobile station. Any particular call may be routed through several wireless and/or terrestrial networks and there are several alternative routes and/or networks through which any particular call can be made.

Different networks and routes may incur different costs and, in addition, a user or service provided may have beneficial agreements or arrangements with the owners or operators of networks or routes which reduce charges. Thus, by selecting the particular route by which a call to be made, the user or operator can reduce his costs and this is generally known as 'least cost routing'.

With conventional terrestrial systems, it is possible to use 'smart boxes' which serve to automatically route a call through the most cost efficient route.

For example, a local call may be routed via one network whereas an international call may be routed via a different network and so on.

Mobile telephone users generally subscribe to, or as associated with a service provider operating a particular proprietary network (the 'home' network). This network will cover a finite area, within the United Kingdom for example. However, once the user travels to a region outside the coverage area of the home network, for example a state within Europe, or for some reason wishes to use a different network having overlapping coverage area, then they may be able to 'roam' by selecting an appropriate network which covers the particular area the user happens to be in and with which the home network has a roaming agreement.

In some countries, network operators offer the ability to have a leased circuit from a cellular switch into a corporate customers internal network (PABX). It is also possible to use several alternative long distance carriers, as mentioned above, for long distance traffic from mobile networks. In order to route a call via alternative carriers, the user usually has to dial an additional prefix before the number of the station he is intending to call. This may typically be a three or four digit prefix.

It is also possible for a mobile user to 'break out'. This involves dialling via a leased line and a PABX into the public network, possibly internationally, thus saving on cellular call rates and taking advantage of any corporate discounts

on telephone traffic. For example, an employee of a company provided with a mobile telephone may be able to dial into the company's telephone network (PABX) and from then to dial into the public network and to make, say, international calls commencing at his mobile station but routed through the PABX at his employer's offices and from then on to the public network. Thus, that call would incur calls from the mobile service provider only from the mobile to his employer and from then on his employer would be charged for the remaining part of the call, at whatever corporate discounts and agreed rates he obtains. This routing would then involve a code for linking the mobile station to the employer's PABX, an additional code enabling break out and then the actual telephone number being dialled. For example, the first code may be 7777, the second may be 9 and then for an international call this would be followed by 00 1 (for a call to the USA for example) and then the telephone number of the party to be called.

This can involve a very long string of digits and it is much more user friendly for the mobile to be programmed with a set of translations to make this route selection automatic.

The present invention arose in an attempt to provide a least cost routing method and selection procedure for mobile telecommunications.

#### Brief Summary of the Invention

According to the present invention in a first aspect there is provided a mobile terminal for a telecommunications system, including a stored routing table, the table being provided with at least a first set of data representative of numbers to be input by a user, and a second set of data representative of numbers to be dialled by the terminal, each mapped to a respective one of the first set of data.

Preferably, the routing table is provided with at least a third further set of data representative of different parameters, or conditions, whereby an item of data of the second set is chosen depending on the selected combination of relevant data from the first set and the third or a further set.

The third or additional set of data may include data representative of the network in which the mobile station may receive service, and/or priority or choice level data.

According to the present invention in a second aspect, there is provided a method of routing calls originated by a mobile station on a telecommunications system, comprising providing a stored routing table which is provided with a first set of data representative of numbers to be input by a user, and a second set of data representative of numbers to be dialled by the terminal, each mapped to a respective one of the first set of data; inputting a number at the terminal;

determining the relevant number to be dialled according to the routing table, and; dialling the relevant number.

Preferably, the routing table is provided with at least a third further set of data representative of different parameters, or conditions, whereby an item of data of the second set is chosen depending on the selected combination of relevant data from the first set and the third or a further set.

According to the present invention in a third aspect, there is provided a telecommunication system, including a mobile terminal having a stored routing table.

Preferably, the routing table is provided with at least a third further set of data representative of different parameters, or conditions, whereby an item of data of the second set is chosen depending on the selected combination of relevant data from the first set and the third or a further set.

According to the invention in a further aspect, there is provided a mobile terminal for a wireless telecommunications system, having a routing table usable to determine the route by which a call from the terminal is to be made.

#### Description of the drawings



An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a schematic diagram of an embodiment of the mobile telecommunications system;

Figure 2 shows a schematic diagram of a further embodiment of a mobile telecommunications system; and

Figure 3 shows an operational flow-chart of the present system.

#### Description of preferred embodiments of the invention

Referring to Figure 1, a remote mobile station 10 is in wireless communication with a cellular network 20. Remote from the user of the station 10 is an alternative carrier or client network 30. A user is able to route a telephone call through the client network 30 by prefixing the dialled number with a 3 or 4 digit code appropriate to the identity of the network 30 (the identity will be in the form of a PLMN code). The code, for example pqrs, routes the call through the client PABX 40.

However, the preferred embodiment of the present system allows the user to directly dial the required number without the need of prefixes and truncation by the advantageous inclusion of routing tables stored within the memory unit 15 of the mobile station 10.

Prior to transmittal 18, the mobile station 10 compares the number dialled by the user with routing codes entered into the table appropriate for the particular

network 20. When part of the entered code (or in certain cases the whole of the code) matches a routing table entry the station checks for a corresponding substitution code. In the event that a corresponding substitution codes exists for the number dialled and the particular network 20 the user happens to currently be in, then the matched element of the entered number will be removed and a substitution code will be inserted as a prefix to the remaining digits to be sent. If no substitution code is present the dialled number will be transmitted as normal and no routing will take place. When routing does occur it takes place via the cellular switch 25 and the client PABX 40.

Figure 2 shows another embodiment of the system. Here the user (unknowingly) is routed through the client network 40 in the same manner as described above, but the call is further routed out into a public network via PSTN line 50. Ordinarily, the user would need to enter the four digit code pqrs as above and a further code t, to access line 50 before dialling his or her required number. The preferred system negates the need for such lengthy dialling by a user. As before, the station 10 compares the number dialled with stored tabulated codes, and where appropriate truncates and prefixes the number before transmittal 18 in order that the call should be routed via a predetermined cheaper route.

Figure 3 shows a schematic flow chart of the present system in operation. At 60 a user inputs the desired destination number into the mobile station 10. The mobile station 20 ascertains in which network it is currently located. The

station then compares the dialled number with entries in the stored routing table appropriate to the relevant PLMN code.

If a match is found 90, then the system will search for a substitution code at step 100. If not, the number will be transmitted as dialled at 130.

If a substitution code exists, the matched digits of the dialled number will be removed and the remaining digits will be prefixed with the correct substitution code. Otherwise the number is transmitted as dialled.

At step 130 the number to be sent is transmitted in the normal way.

The following table is given as a further example only of the preferred system. The table shows possible entries for a routing table for routing calls from a network with the PLMN code 234-01, and shows some of the logic behind the types of translation envisaged. In the table the code pqrs is assumed to be 7777.

Entry	Translate from	to	Choice	PLMN	Comments
1	01256817474	77770	1	234-01	full number for switchboard translated.
2	01256817474		2	234-01	If first choice does not apply or route is congested, use second-choice translation.
3	01256790	77773	1	234-01	Picks up Direct Dial In (DDI) calls to a switchboard
4	0385		1	234-01	blank = no translation (cheaper direct)
5	0860		1	234-01	blank = no translation (cheaper direct)
6	3xxx	77773xxx	1	234-01	Treats any 4-digit number commencing 3 and sends xxx after translation. Enables extension numbers to be entered directly.
7	00		1	NOT 234-01	Only do the translation if you are not on the network 234-01.
8	0	777790	1	234-01	Go to switchboard, get outside line and send over PSTN. This effectively routes all other calls not excluded or routed above via a switchboard

Updating of the table would be either by keypad entry, pre-programming, or remote programming of the table via the GSM/DCS/PCS 1900 Short Message Service.

As GSM/DSC/PCS 1900 is a 'roaming' system, the translations which apply will be likely to differ depending upon whether you are on the home PLMN or are roaming. This is taken into consideration by means of a 'PLMN' column, which defines which networks are included or excluded from a particular translation. The example of table 1 only includes 234-01, or 'NOT' 234-01 in column 4. In practise, many other alternative networks may be included in this column. The system looks for the correct match of number input, PLMN number, choice level etc and then select the required value from the 'choice' column.

Using proprietary encoding of both Mobile-Originated and Mobile-Terminated Short Messages, the above translation table can be queried, edited and deleted remotely. Message for doing this are well known.

Service providers wishing to offer managed tariff optimisation could use the above system to maximise use of a particular Mobile-to-PABX link or a cost effective long distance carrier where the user of the mobile phone may not remember (or choose to use!) the cheapest route for a particular call. This feature enables that function to be incorporated automatically and maintained up to date.

### CLAIMS

1. A mobile terminal (10) for a telecommunications system, including a stored routing table (15), the table being provided with at least a first set of data representative of numbers to be input by a user, and a second set of data representative of numbers to be dialled by the terminal, each mapped to a respective one of the first set of data.
2. A mobile terminal as claimed in Claim 1, wherein the routing table is provided with at least a third further set of data representative of different parameters, or conditions, whereby an item of data of the second set is chosen depending on the selected combination of relevant data from the first set and the third or a further set.
3. A mobile terminal as claimed in Claim 2, wherein the third set of data comprises location data representative of the network or networks in which the mobile station may receive service.
4. A mobile terminal as claimed in Claim 2 or Claim 3, wherein the table includes a set of data representative of choice- or priority- levels.
5. A method of routing calls originated by a mobile station on a telecommunications system, comprising providing a stored routing table (15) which is provided with a first set of data representative of numbers to be input by

a user, and a second set of data representative of numbers to be dialled by the terminal, each mapped to a respective one of the first set of data; inputting a number at the terminal (60); determining the relevant number to be dialled according to the routing table (110, 120), and; dialling the relevant number (130).

6. A method as claimed in Claim 5, wherein the routing table is provided at a mobile station (10).

7. A method as claimed in Claim 6 or Claim 7, including providing at least one further set of data in the routing table representative of different parameters or conditions (70), and dialling a number determined by the number input and the or each relevant further data item stored.

8. A method as claimed in Claim 7, wherein location data is provided representative of the networks in which a mobile terminal may receive service (70).

9. A method as claimed in any of Claims 5 to 8 (110), wherein the number dialled is obtained by removing part of the number input by the user, and adding a number or numbers (126) determined by the second or further data sets to the remaining part of the number input by the user.

10. A telecommunication system, including a mobile terminal (10) having a stored routing table (15), the table being provided with at least a first set of data representative of numbers to be input by a user, and a second set of data representative of numbers to be dialled by the terminal, each mapped to a respective one of the first set of data.
11. A telecommunication system as claimed in Claim 10, wherein the routing table is provided with at least a third further set of data representative of different parameters, or conditions, whereby an item of data of the second set is chosen depending on the selected combination of relevant data from the first set and the third or a further set.
12. A telecommunication system as claimed in Claim 11, wherein the third set of data comprises location data representative of the network or networks in which the mobile station may receive service.
13. A telecommunication system as claimed in Claim 11 or Claim 12, wherein the table includes a set of data representative of choice- or priority- levels.
14. A mobile terminal (10) for a wireless telecommunications system, having a routing table (15) usable to determine the route by which a call from the terminal is to be made.



15. A mobile terminal for a telecommunication system substantially as hereinbefore described with reference to the accompanying drawings.
16. A telecommunications system substantially as hereinbefore described, with reference to, and as illustrated by, the accompanying drawings.
17. A method of routing calls originated from a mobile station, substantially as hereinbefore described with reference to, and as illustrated by, the accompanying drawings.



Application No: GB 9924887.4  
Claims searched: 1-14

Examiner: Anita Keogh  
Date of search: 2 May 2000

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.R): H4K (KBC, KBNX, KED, KER, KEX), H4L (LECCX, LESF, LDSY)

Int CI (Ed.7): H04M (1/274), H04Q (7/32, 7/38)

Other: Online: WPI, JAPIO, EPODOC

### Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X, Y	GB 2328117 A	(PATHFINDER) see especially page 15 line 14 to page 17 line 26, page 19 lines 17-20, page 27 lines 5-18, page 32 lines 18-21, page 37 lines 14-20 and figs 3-5, 12	X: 1-8, 10-14 Y: 9
A	GB 2300089 A	(EUROTEL) see figure 3 and page 1 lines 4-26, page 3 lines 18-29, page 4 line 35 to page 5 line 6 and page 11 lines 7-19	1, 5, 10 at least
Y	GB 2282732 A	(MOTOROLA) see especially page 8 line 34 to page 9 line 15, page 13, lines 8-14, page 17 line 30 to page 23 line 1 & figs 2-8	9
X, Y	WO 98/20663 A2	(NOKIA) see whole document, especially figs 1a, 1b, 2 & 3	X: 1, 5, 6, 10 at least Y: 9
X, Y	WO 98/20662 A2	(NOKIA) see whole document, especially figs 1, 2 and 3	X: 1, 5, 6, 10 at least Y: 9
X, Y	WO 97/11546 A1	(ERICSSON) see especially page 5 line 10 to page 6 line 9, page 10 line 15 to page 11 line 31 and fig. 2	X: 1, 5, 6, 7, 8, 10 Y: 9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.



Application No: GB 9924887.4  
Claims searched: 1-14

Examiner: Anita Keogh  
Date of search: 2 May 2000

Category	Identity of document and relevant passage	Relevant to claims

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

**THIS PAGE BLANK (USPTO)**

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

☐ BLACK BORDERS

☒ ~~IMAGE CUT-OFF AT TOP, BOTTOM OR SIDES~~

☒ ~~FADED TEXT OR DRAWING~~

☒ ~~BLURRED OR ILLEGIBLE TEXT OR DRAWING~~

☐ SKEWED/SLANTED IMAGES

☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS

☐ GRAY SCALE DOCUMENTS

☐ LINES OR MARKS ON ORIGINAL DOCUMENT

☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY

☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**

